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Effect of Mesh Size and Shape on the Selectivity of Cod Traps

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ABSTRACT

Brothers, G. and Hollett, J., 1991. Effect of Mesh Size and Shape on the Selectivity of Cod Traps. Can. Tech. Rep. Fish. Aquat. Sci.

During the summer of 1990, experimental cod trap projects were carried out in eight communities along the coast of Newfoundland. The experiment investigated the effect of the mesh size and shape on both the catch rates of small fish, and the amount of meshing that occurred in the sides and backs of the traps. The purpose of this work was to add to the current knowledge of cod trap mesh size selectivity and thereby determine an appropriate mesh size to reduce the catch rates of small fish.

To accomplish this objective, three specific elements were met: (1) to determine the level of reduction in small fish landings resulting from different minimum mesh sizes; (2) to ascertain the loss to the trap fishermen that would result from increasing the minimum mesh size beyond 89mm (3.5"); (3) to decide if mesh size has any affect on the amount of meshing in cod traps.

The results of this experimental study indicate that: (1) increasing the minimum mesh size from 89mm (3.5") to 102mm (4.0") or beyond caused a significant reduction in the amount of small fish landed; (2) the amount of meshing was not related to mesh size over the range of sizes tested; (3) square mesh appears to significantly reduce both the amount of small fish landed and the amount of meshing.

RESUMÉ

Brothers, G. et Hollett, J., 1991. Effect de la grandeur et de la forme des mailles sur la sélectivité des trappes á morue. Can. Tech. Rep. Fish. Aquat. Sci.

Au cours de l'été 1990, huit localités côtiéres de Terre Neuve ont participé á une étude expérimentale sur les trappes à morue. Il s'agissait d'étudier l'effet de la grandeur et de la taille des mailles sur le taux de capture des poissons de petite taille et sur le taux d'emmaillage survenant sur les côtés et à l'arrière des trappes. Cette initiative avait pour objectif d'élargir les connaissances actuelles sur la sélectivité de la grandeur des mailles des trappes à morue et, de là, de déterminer une grandeur de maille permettant de diminuer le taux de capture de poissons de petite taille.

Dans ce but, trois éléments précis étaient recherchés: (1) établir le taux de réduction des débarquements de poissons de petite taille entraîné par l'utilisation de différentes grandeurs de mailles; (2) évaluer les pertes qu'encourraient les pêcheurs aux trappes advenant une augmentation au delà de 89 mm (3.5 po) de la grandeur minimale des mailles; (3) déterminer si la grandeur des mailles a un effet quelconque sur le taux d'emmaillage dans les trappes à morue.

Les résultats de cette étude expérimentale révèlent que: (1) l'augmentation de 89 mm (3,5 po) à 102 mm (4 po) de la grandeur des mailles a causé une réduction significative des débarquements de poissons de petite taille; (2) le taux d'emmaillage n'a pas de rapport avec la grandeur des mailles, du moins en ce qui concerne les grandeurs évaluées; (3) les mailles carrées semblent réduire de façon notable tant la quantité de poissons de petite taille capturés que le taux d'emmaillage.

INTRODUCTION

The cod trap is an important gear component of the Newfoundland fishery. With its minimum mesh size of 89mm(3.5"), the cod trap has always caught substantial amounts of small fish. The introduction of the Japanese cod trap has compounded this problem. Realizing the benefits of reducing the catch of small cod (increased spawning biomass and increased yield through (a) waste reduction (b) a subsequent increase in the biomass of these age groups at the time of harvest and (c) an increased average value of harvest), the Provincial Department of Fisheries and the Department of Fisheries and Oceans have carried out several projects on mesh size selectivity in cod traps.

In 1990, further experimental work was conducted by the Fisheries Development Division, in co-operation with Science and Program Coordination & Economics Branches. The purpose of this work was to add to the current knowledge of cod trap mesh size selectivity and therby determine an appropriate mesh size to reduce the catch of small fish.

To accomplish this, three specific objectives were met: (1) to determine the level of reduction in small fish (refers to fish under 43cm (17") fork length) landings resulting from different minimum mesh sizes; (2) to determine the loss to the trap fisherman that would result from increasing the minimum mesh size beyond 89mm(3.5"); (3) to determine if mesh size has any affect on the amount of meshing in cod traps.

METHODS

Experiments were carried out in eight areas along the coast of Newfoundland (Fig. 1). In each area one or two traps with the largest mesh sizes or square mesh are referred to as experimental traps, while the other traps with the smaller mesh sizes are used as controls for comparison to the experimental traps. While, in each area, one or two traps are referred to as experimental traps, only three traps (from St. Stephen's, Cape Broyle and Port Kirwan) were actual experimental designs proposed by the fishermen involved. The other experimental traps were existing traps that fishermen had been using in the past for various reasons. Each trap was given a Letter/Number designation for ease of referral. The following is a description of the traps that were monitored in each area. (Detailed specifications are given in Appendix B).

1. LAWN. Two experimental Newfoundland traps with 102mm (4") mesh in the back and side walls (TRAPS D1 & D3) were compared to two Newfoundland traps with 89mm(3.5") mesh in the back and side walls (TRAPS D2 & D4).

2. ST. STEPHEN'S. One experimental Japanese trap was constructed with 102mm(4") mesh in the back and 102mm(4") and 127mm(5") mesh in the sides (TRAP C1). It was compared to two Japanese traps with 92mm (3 5/8") mesh in the bodies (TRAPS C2 & C3).

3. PORT KIRWAN. One experimental Japanese cod trap was constructed with 102mm(4") square mesh in the body (TRAP A1). It was compared to one Modified Newfoundland trap with 92mm(3 5/8") diamond mesh throughout the trap (TRAP A2).

4. CAPE BROYLE. One experimental Japanese trap was constructed with 89mm(3.5") square mesh in the body (TRAP B1). It was compared to two Japanese traps with 89mm(3.5") diamond mesh in the bodies (TRAPS B2 & B3).

5. Bonavista. Two experimental Newfoundland traps with 102mm (4") mesh in the back walls (TRAPS E1 & E3) were compared to one Newfoundland trap with 89mm (3.5") mesh in the back wall (TRAP E2). The side walls of the traps contained 127mm(5") and 152mm (6") mesh.

6. FOGO. One experimental Newfoundland trap with 152mm (6"), 127mm (5") and 102mm (4") mesh in the sides and 102mm (4") mesh in the back (TRAP F1) was compared to two Japanese traps with 89mm (3.5") mesh throughout the trap bodies (TRAPS F1 & F2).

7. LA SCIE. One experimental Newfoundland trap with 127mm (5") mesh in the sides and 89mm (3.5") mesh in the back (TRAP G1) was compared to one Japanese trap with 152mm (6") mesh in the sides and 89mm (3.5") mesh in the back (TRAP G2).

8. CONCHE. One experimental Newfoundland trap with 203mm (8") mesh in the sides and 89mm (3.5") mesh in the back (TRAP H1) was compared to two Japanese traps with 89mm (3.5") mesh throughout the trap bodies (TRAPS H2 & H3).

Each trap was monitored daily, by a DFO representative. The following information was recorded each time the traps were hauled for the entire trap season or 50 fishing days (which ever came first):

(1) The total weight of the catch. This was obtained from the trap owner's receipts.

(2) The fork lengths (3cm groupings) of a random sample of 200 fish that are dipped or brailed on board the skiff. These were measured with standard 80 cm measuring boards.

(3) The fork lengths (3cm groupings) of a random sample of 200 meshed fish from designated sections of the side and back walls of the traps. These were measured with standard 80cm measuring boards.

(4) The total weight of meshed fish from each of the designated sections mentioned above. This was estimated by filling fish pans carrying a particular weight of cod.

In each area, sampling began with the first sign of fish. Before sampling commenced, a DFO representative met with each monitor to train him/her in the appropriate data collection and reporting techniques. This was followed up soon after by one or more onboard training sessions.

To ensure that all the traps in the study areas were fishing

properly, underwater video footage was taken of each trap (before, or shortly after sampling commenced) using a remotely operated vehicle (ROV). The underwater video could be seen from an onboard TV monitor so that the skipper and crew could see any problems with the traps and direct the ROV pilot to areas of particular concern. When problems were discovered, they would either be rectified with the ROV still filmimg the trap, or attended to later. If serious problems were discovered, a follow up trip was made to ensure that the problem had been properly corrected.

Underwater video was taken in all locations except Bonavista, where poor weather and tide conditions as well as boat trouble prevented the video observations.

DATA ANALYSIS

For each experiment the following paramaters were estimated:

1. The average length of fish retained by the traps;
2. The average length of fish meshed in the back and side walls of the traps;
3. The percent reduction (by number) in small fish resulting from using traps with large or square mesh rather than traps with the minimum 89mm (3.5") or 92mm (3 5/8") mesh sizes. The following method was used to estimate this paramater:

   With x = the percent of the experimental trap catch that is small and y = the percent of the control trap catch that is small, the percent reduction in small fish is y-x/y * 100.
4. The percent reduction (by number and weight) in trap landings resulting from using traps with large or square mesh rather than

traps with the minimum 89mm (3.5") mesh size. This was estimated using the method of Mercer (1977) and is based on the following assumptions:

A. All traps in an area are exposed to the same size frequency of fish;

B. The control traps would retain as many large fish as the experimental traps. For this purpose, large fish refers to fish greater than 50 cms fork length (the range over which Bishop (1982) found the selectivity of 89mm (3.5") and 102mm (4") traps to be similar);

Given the proportion of total catch from the control traps that is small (x) and the actual amount of large fish from the experimental traps (y), the hypothetical catch of small fish from the experimental traps (z) can be calculated from the following equation: $y/y+z = x$. Given the hypothetical catch that would have been caught if a control trap had been used in the trap berth instead of the experimental trap and the actual catch, one can then calculate the percentage of catch that was lost as a result of using the experimental trap.

RESULTS

1. Lawn. The trap fishery in this area was generally poor, with less than 90,000 lbs. being landed from the four traps monitored (Table 1). Figures 2 & 3 show that the 102mm mesh traps (D1 & D3) caught significantly less small fish than did the 89mm mesh traps (D2 & D4). The average percent reduction in small fish landings was 44% by number (Table 2). The average lengths of trapped and meshed fish from the 102mm traps were greater than in the 89mm traps (Tables 7 & 8). The estimated catch loss from using the 102mm mesh traps is approximately 35% by weight and number (Table 2).

There was no relationship between mesh size and the amount of meshing that results (Table 9).

2. ST. STEPHEN'S. Sampling began June 30. After a slow start, catches picked up, with over 100,000 lbs being landed from the three traps (Table 1). Figures 4 & 5 show that significantly less small fish was landed in the experimental large mesh trap (C1) than in the other 92mm mesh traps (C2 & C3). The average reduction in small fish landings was 59% (Table 3). Tables 7 & 8 show that the average length of trapped and meshed fish from the experimental trap was greater than that of the other traps. The estimated catch loss from using the experimental trap was 53% by weight and 69% by number (Table 3).

The trap owner reported that a large amount of fish escaped through the 127mm mesh in the sides of the trap.

FIG. 1: COD TRAP MESH SIZE SELECTIVITY STUDIES

DISTRIBUTION OF EXPERIMENTS

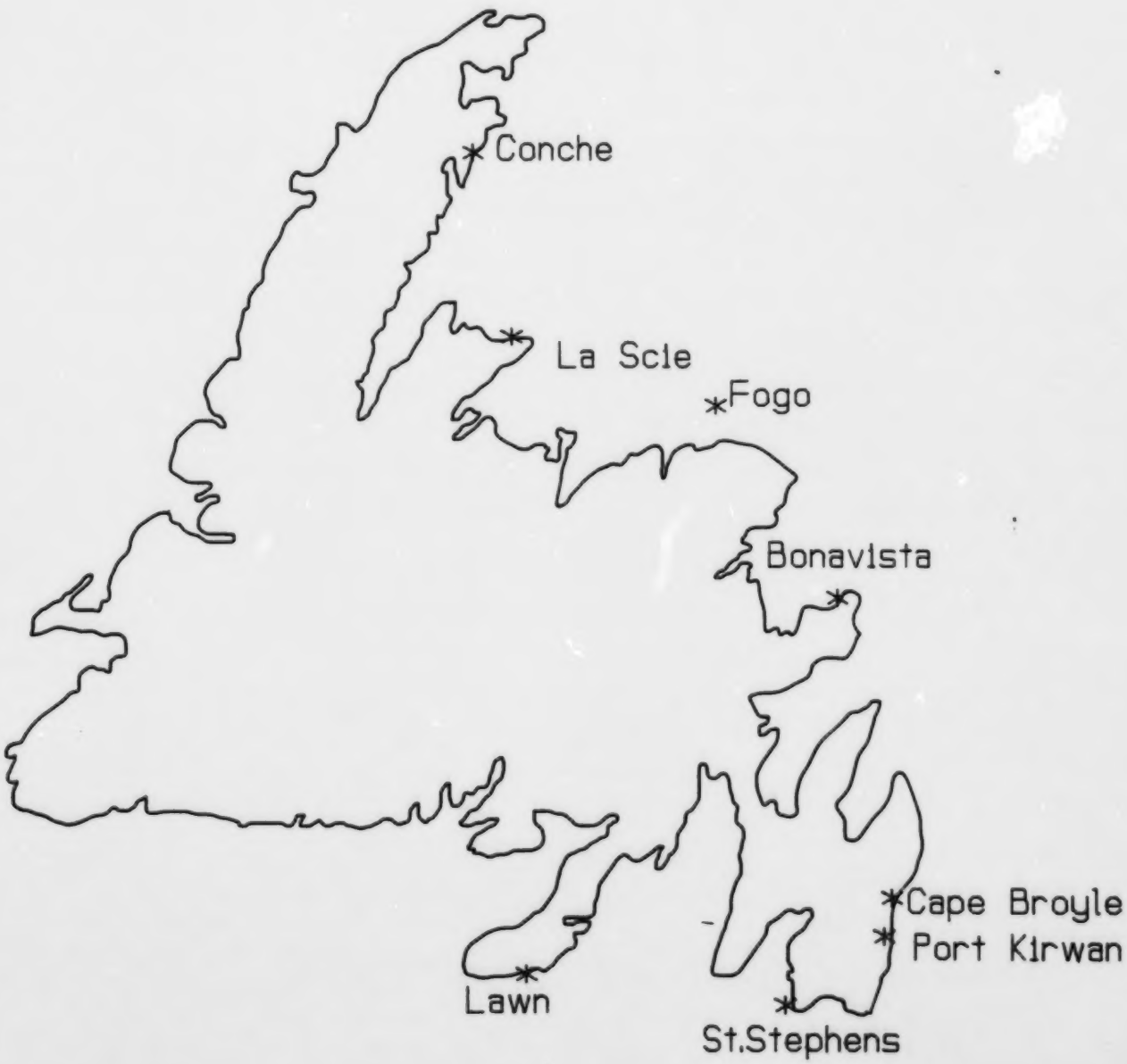


Table 1. Catch summary.

LOCATION	TRAP	# HAULS	TOTAL CATCH(ROUND WEIGHT)
LAWN	D1	10	5,244kg (11,550lbs)
LAWN	D2	11	14,119kg (31,100lbs)
LAWN	D3	21	14,437kg (31,800lbs)
LAWN	D4	9	6,969kg (15,350lbs)
ST. STEPHEN'S	C1	14	14,846kg (32,700lbs)
ST. STEPHEN'S	C2	13	23,449kg (51,650lbs)
ST. STEPHEN'S	C3	14	9,534kg (21,000lbs)
PORT KIRWAN	A1	7	5,334kg (11,700lbs)
PORT KIRWAN	A2	3	341kg (750lbs)
CAPE BROYLE	B1	15	41,359kg (91,100lbs)
CAPE BROYLE	B2	8	9,579kg (21,100lbs)
CAPE BROYLE	B3	14	26,786kg (59,000lbs)
BONAVISTA	E1	28	18,092kg (39,850lbs)
BONAVISTA	E2	32	16,162kg (35,600lbs)
BONAVISTA	E3	21	19,068kg (42,000lbs)
FOGO	F1	61	29,215kg (64,350lbs)
FOGO	F2	18	5,039kg (11,100lbs)
FOGO	F3	10	5,312kg (11,700lbs)
LA SCIE	G1	19	1,294kg (2,850lbs)
LA SCIE	G2	23	9,194kg (20,250lbs)
CONCHE	H1	24	1,135kg (2,500lbs)
CONCHE	H2	5	2,974kg (6,550lbs)
CONCHE	H3	9	12,349kg (27,200lbs)

Fig 2. Length Frequencies

Lawn

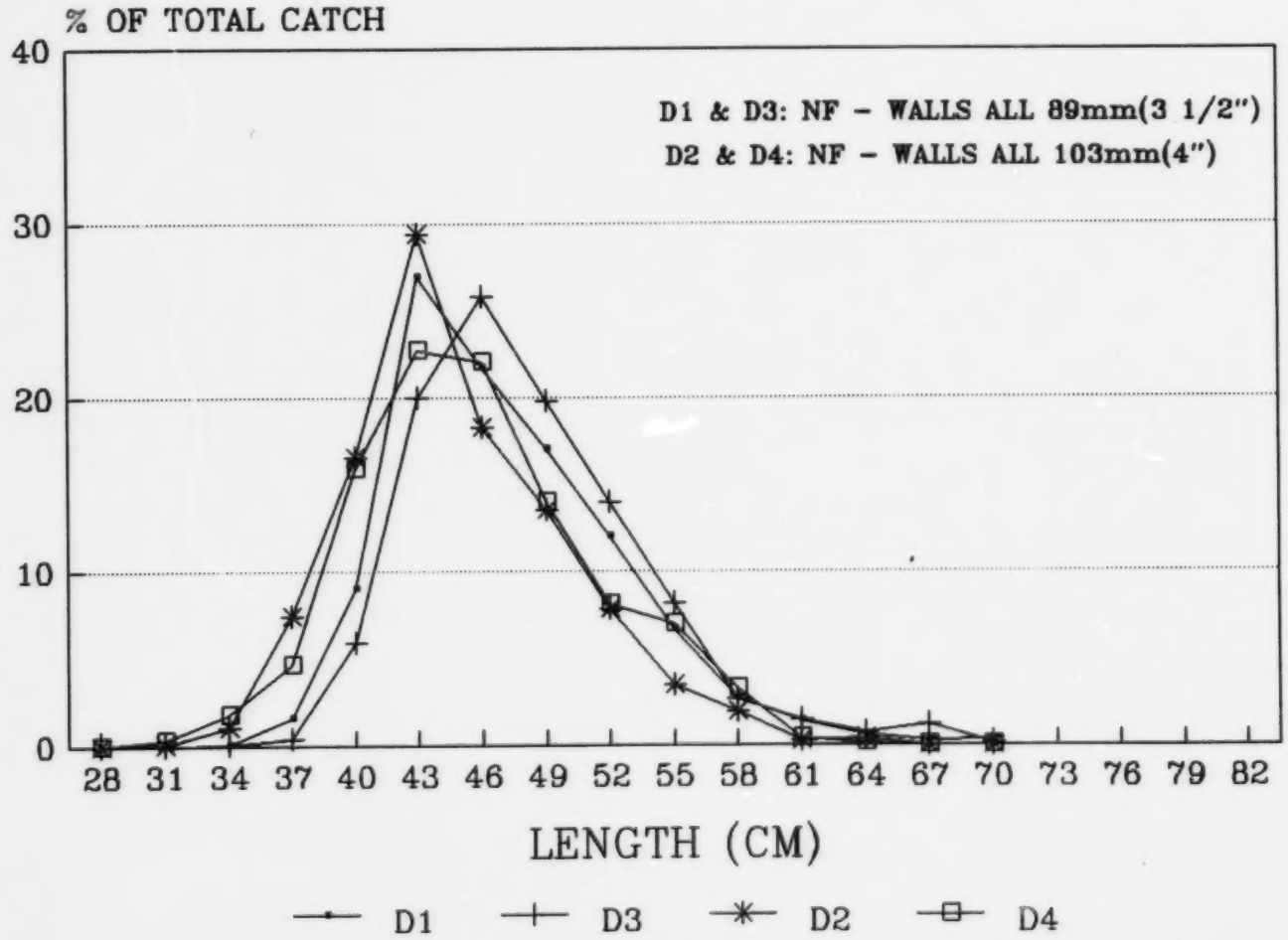
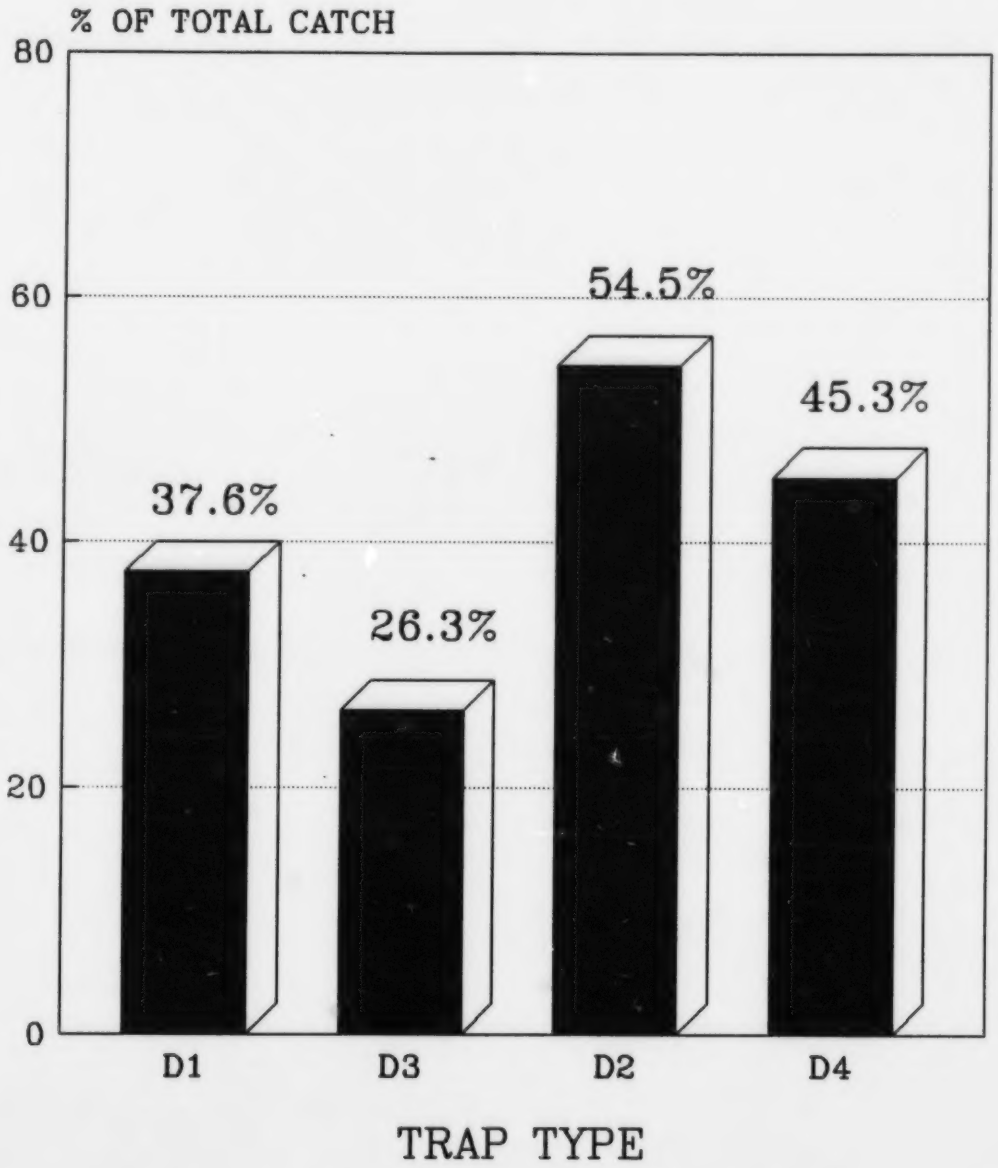


Fig 3. % Of Catch Under 43 cm (17")

Lawn



D1 & D3: NF - SIDE AND BACK WALLS ALL 102mm (4") MESH

D2 & D4: NF - SIDE AND BACK WALLS ALL 89 (3.5") MESH

Fig. 4 Length Frequencies
St. Stephen's

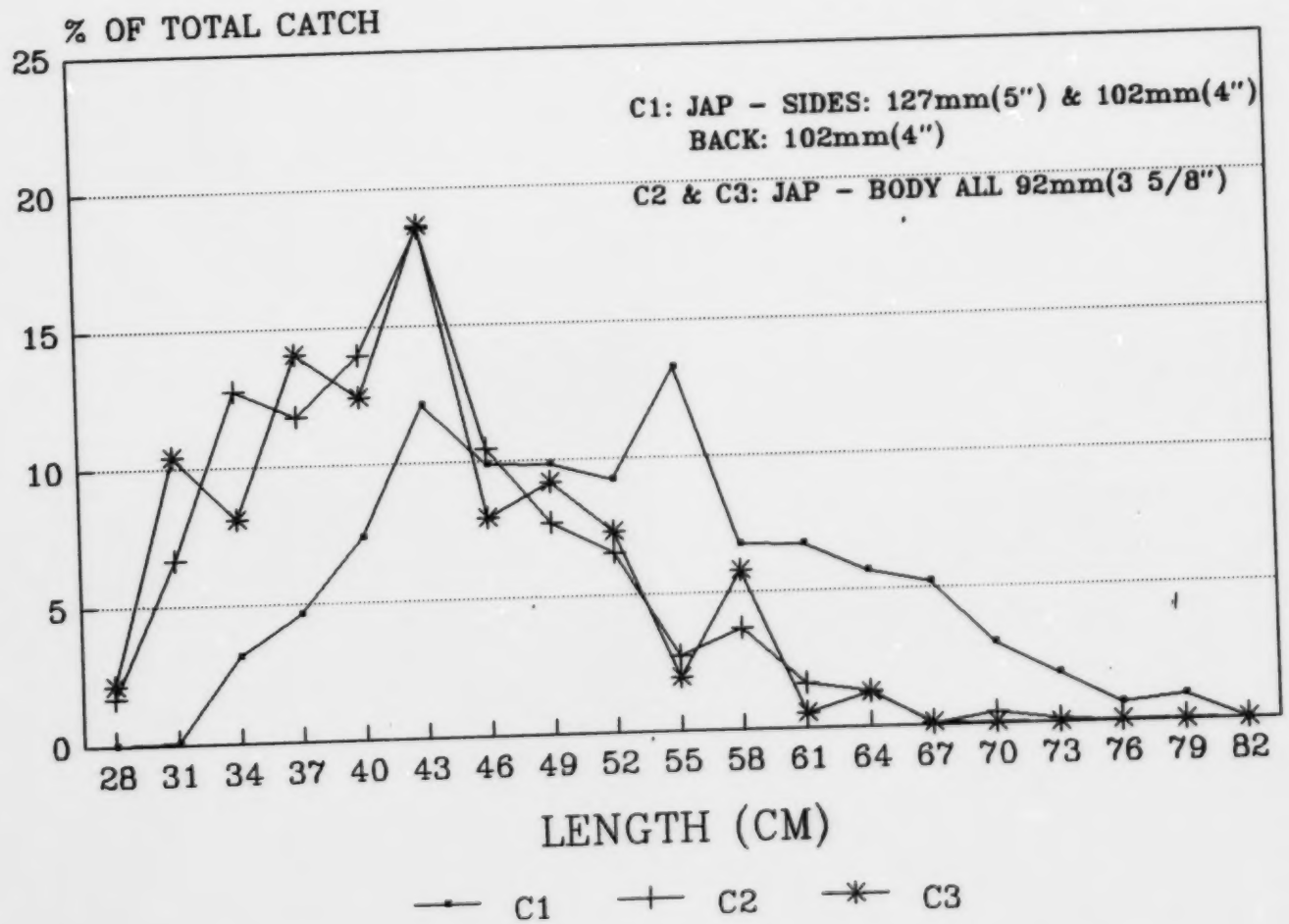
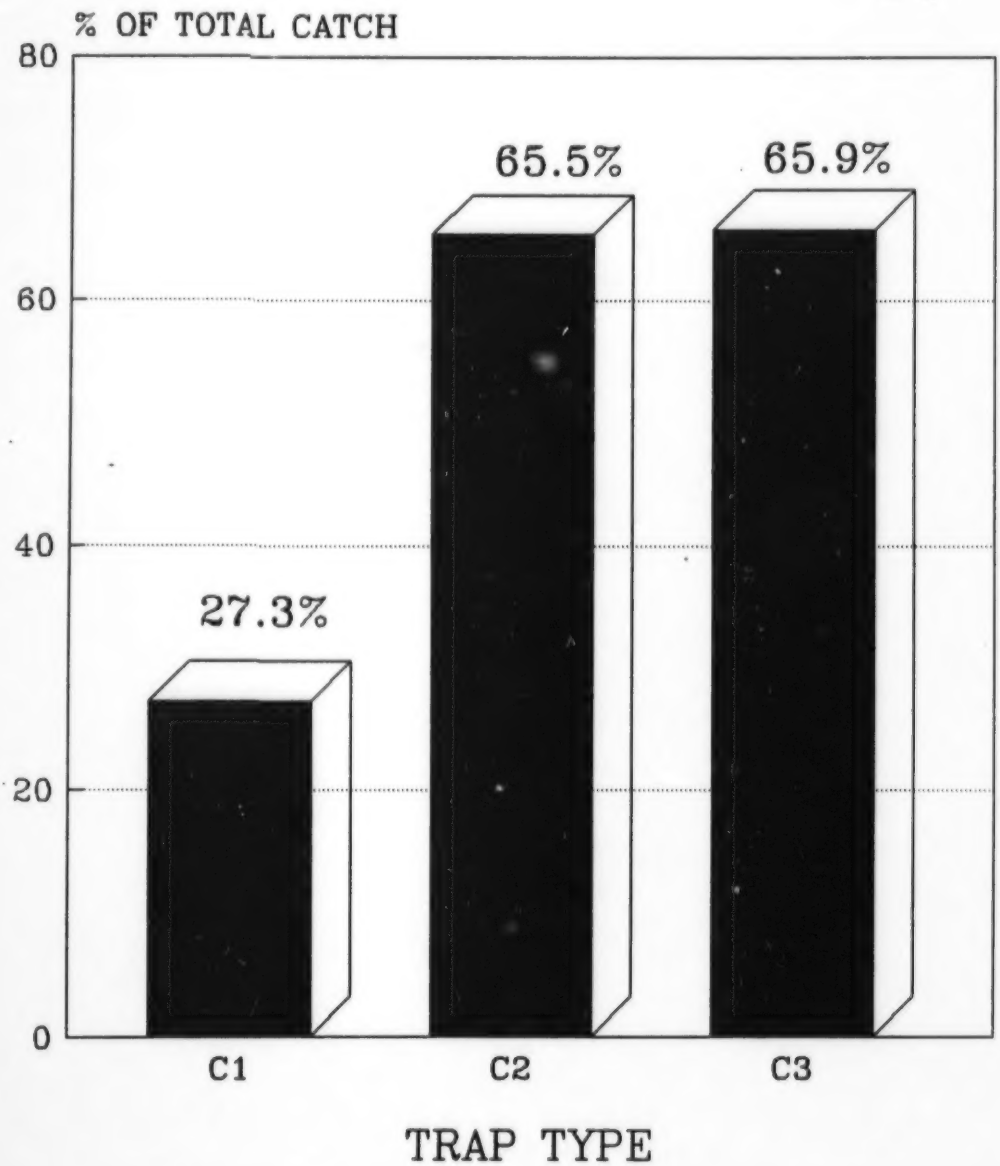


Fig 5. % Of Catch Under 43 cm (17")
St. Stephen's



C1: JAP - SIDES: 127mm(5") & 102mm(4") BACK: 102mm(4")

C2 & C3: JAP - BODY ALL 92mm(3 5/8")

Fig 6. Length Frequencies

Cape Broyle

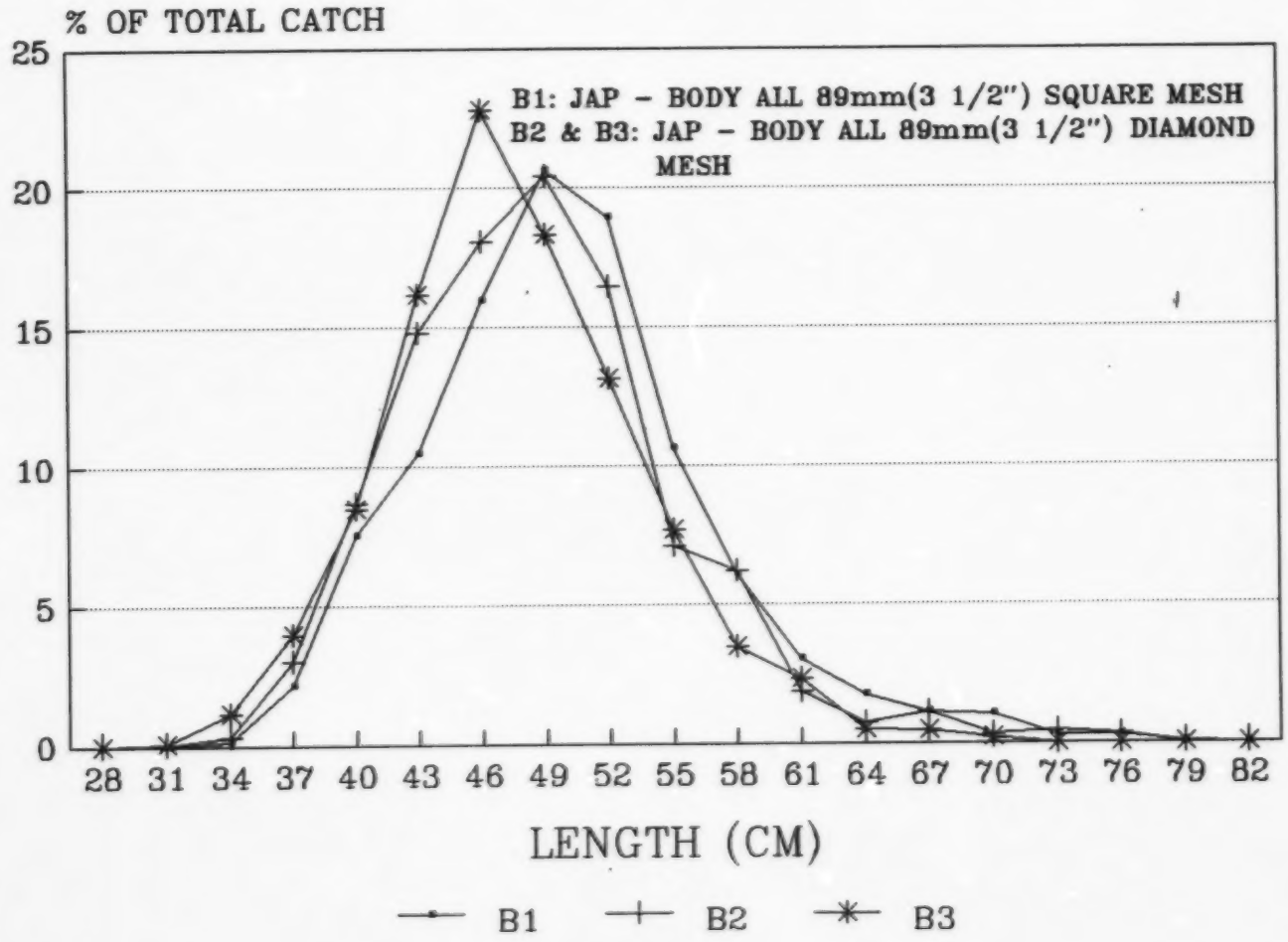
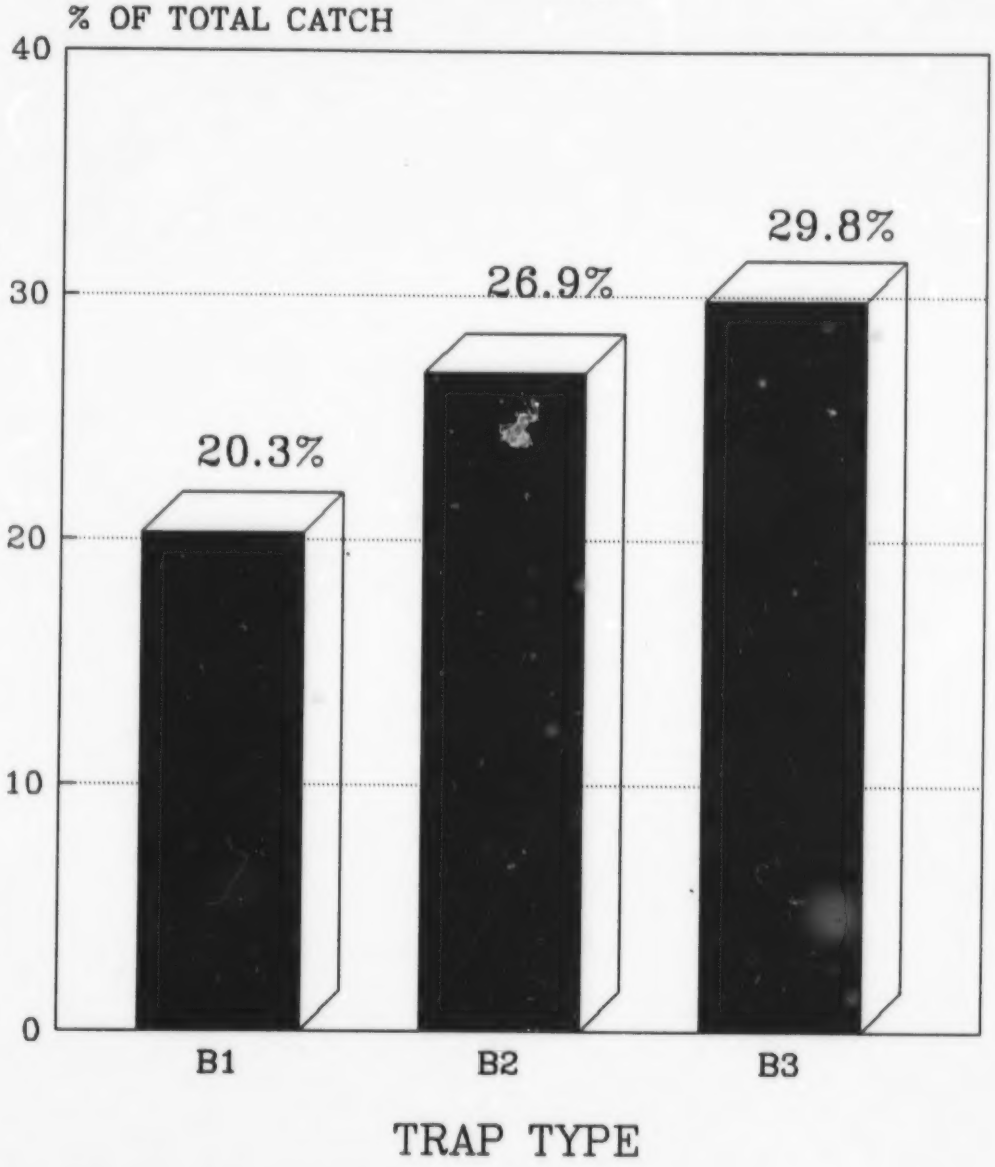


Fig 7. % Of Catch under 43 cm (17")
Cape Broyle



B1: JAP - BODY ALL 89mm(3 1/2") SQUARE MESH

B2 & B3: JAP - BODY ALL 89mm(3 1/2") DIAMOND MESH

Fig 8. Length Frequencies

Bonavista

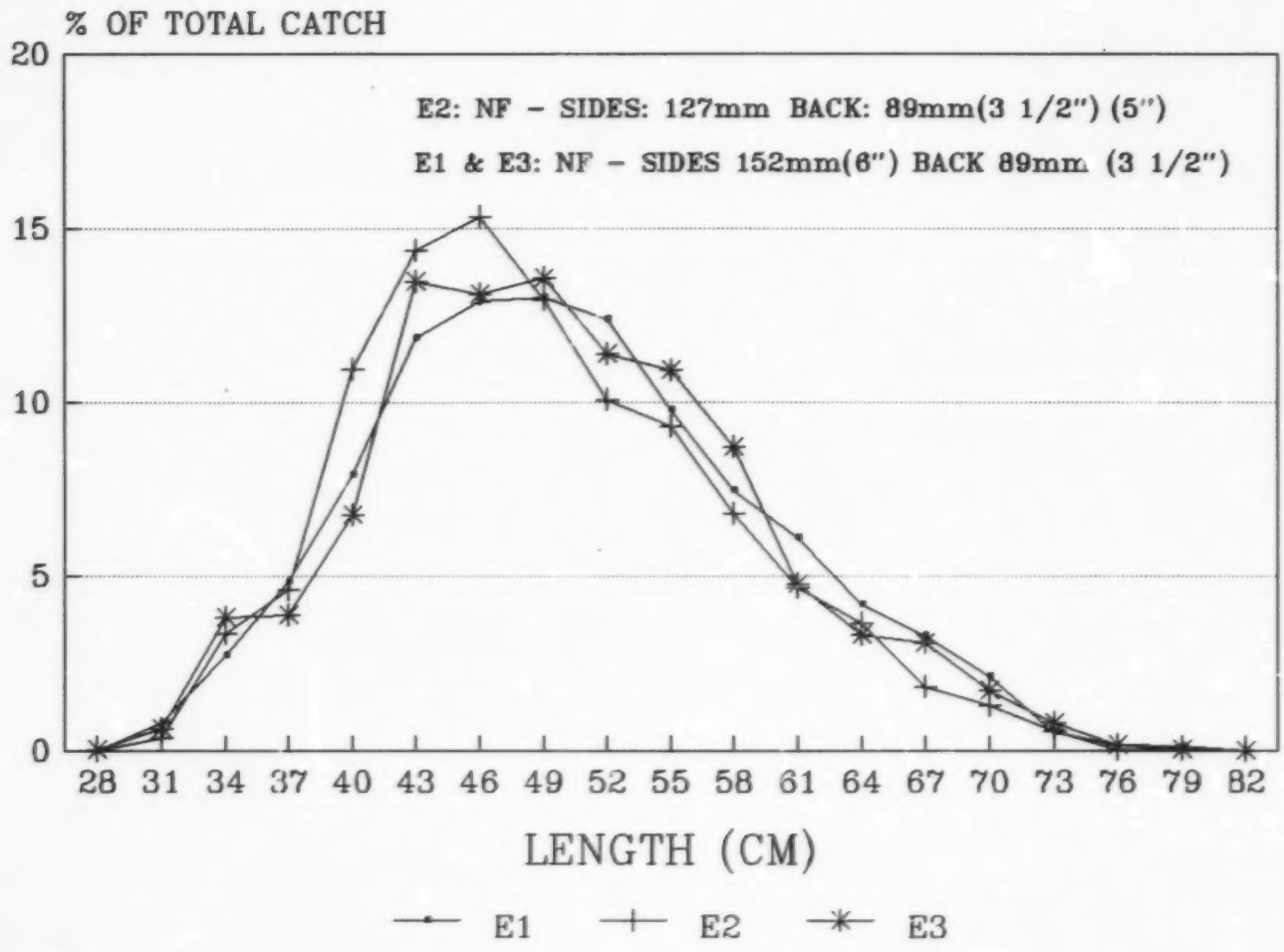
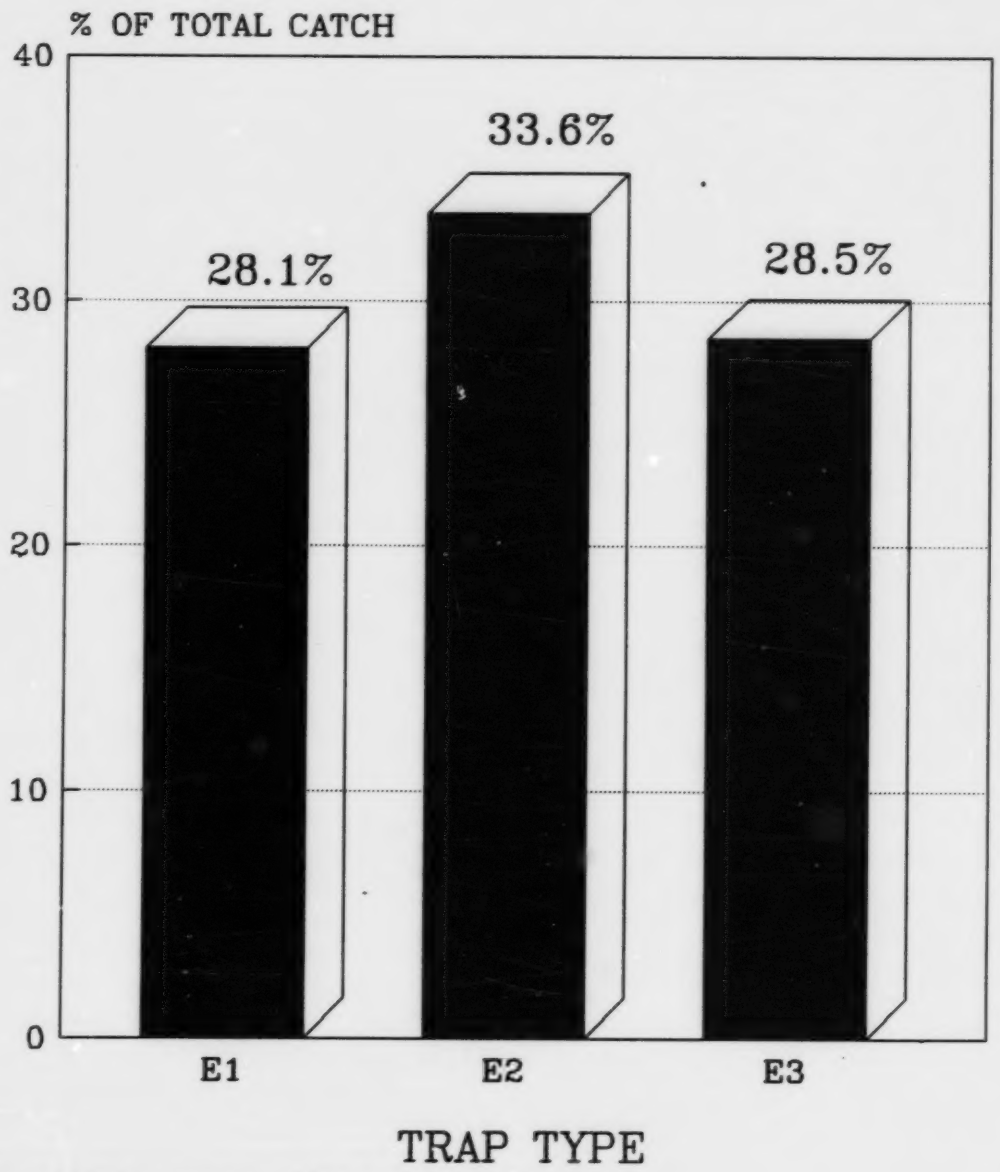


Fig 9. % Of Catch Under 43 cm (17")

Bonavista



E2: NF - SIDES: 127mm (5") BACK: 89mm(3.5")

E1 & E3: NF - SIDES: 152mm(6") BACK 102mm(4")

Fig 10. Length Frequencies

Fogo

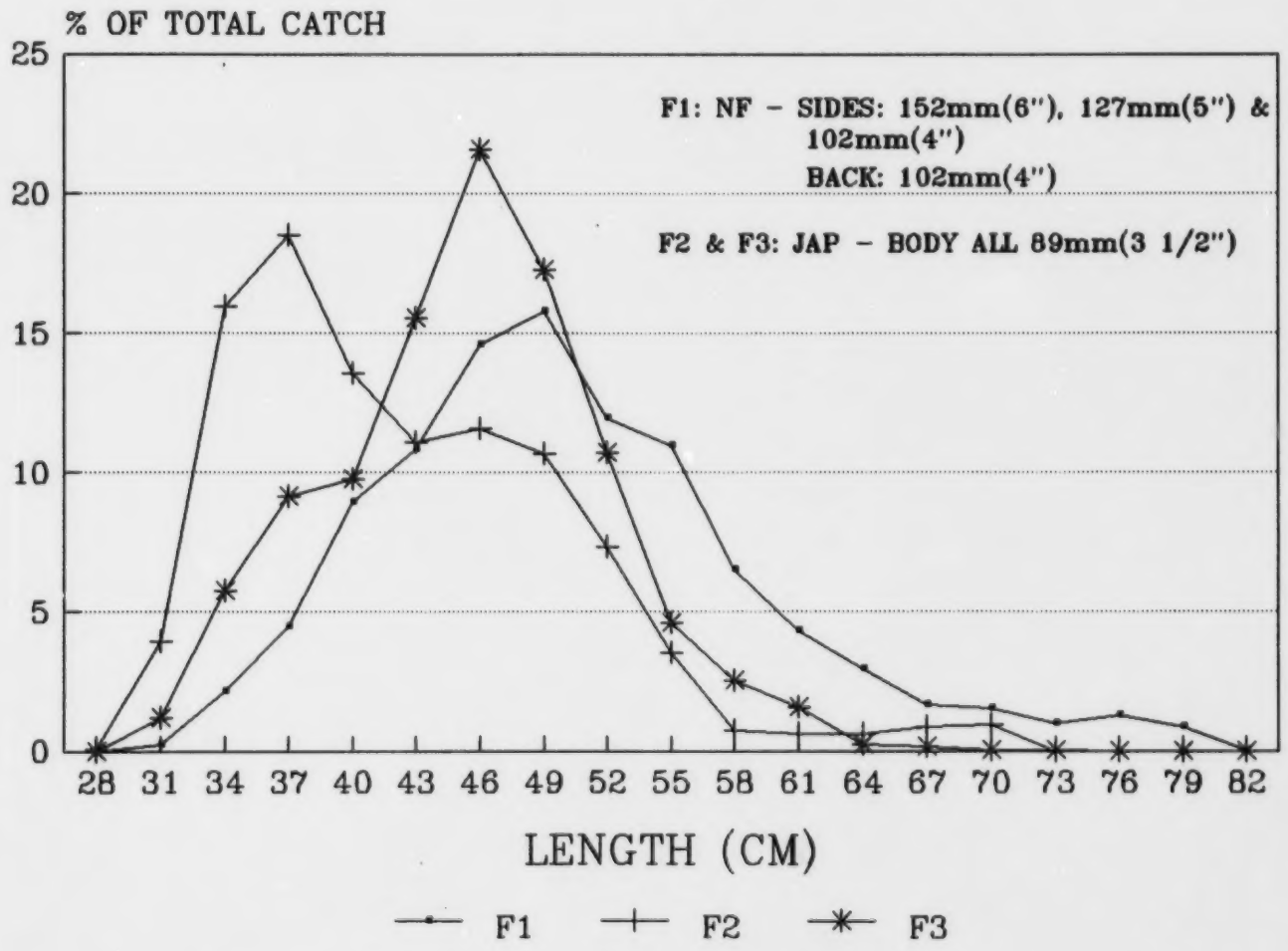
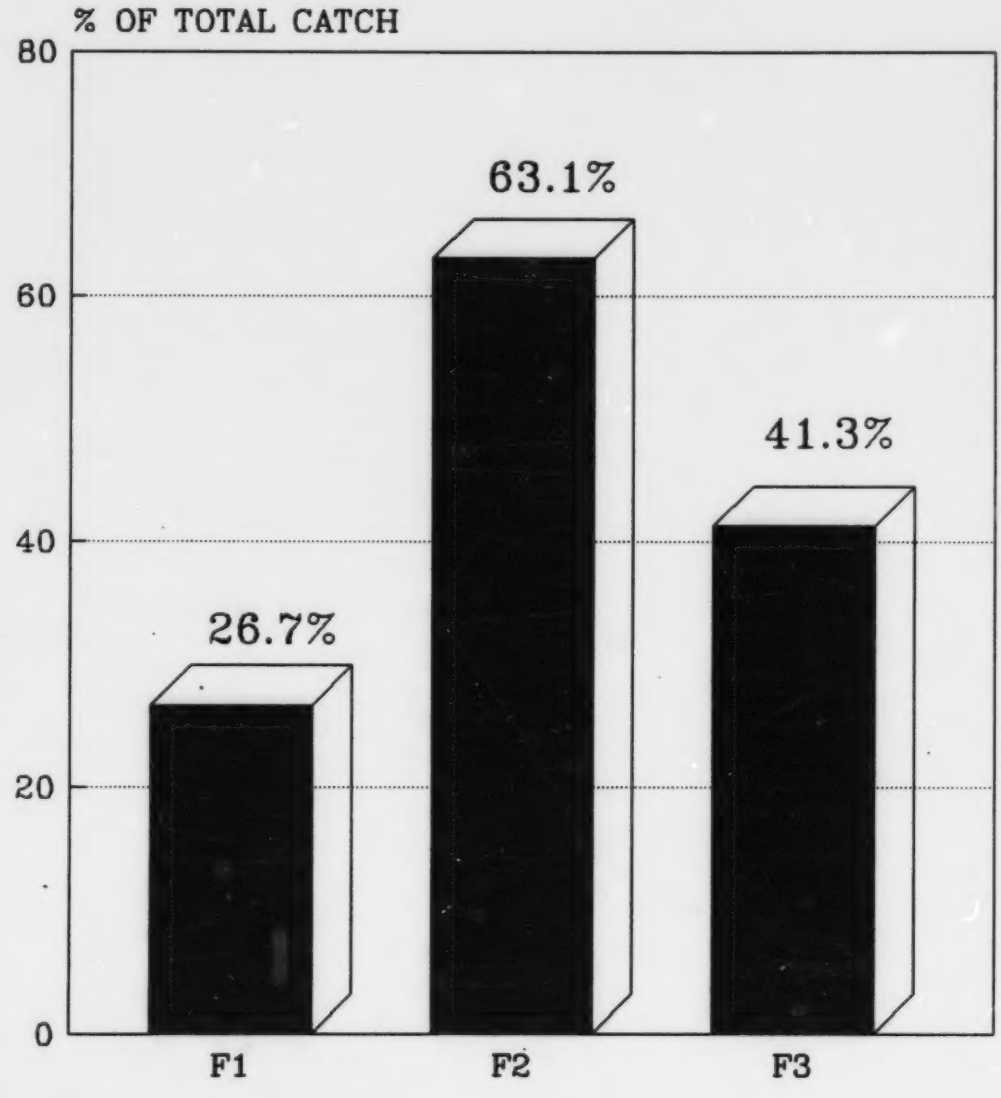


Fig 11. % of Catch Under 43 cm (17")
Fogo



F1: NF - SIDES: 152mm(6"), 127mm(5") & 102mm(4") BACK: 102mm(4")

F2 & F3: JAP - BODY ALL 89mm(3 1/2")

Table 2. Estimated percent reduction in small fish and total catch from using Newfoundland traps with 102mm(4") mesh in the sides and back rather than 89mm(3.5") mesh in the sides and back in Lawn.

% reduction by number in small fish	% reduction by number in total catch	% reduction by weight in total catch.
range(average)	range(average)	range(average)
17-52 (44)	21-51 (35)	16-43 (35)

Table 3. Estimated percent reduction in small fish and total catch from using Japanese traps with 102mm(4") mesh in the back with 102mm(4") & 127mm(5") mesh in the sides rather than traps with 92mm(3 5/8") mesh throughout the trap bodies in St. Stephen's.

% reduction by number in small fish	% reduction by number in total catch	% reduction by weight in total catch
range(average)	range(average)	range(average)
58-59(59)	68-69(69)	52-53(53)

Table 4. Estimated percent reduction in small fish and total catch from using Japanese traps with 89mm(3.5") square mesh in the trap body rather than Japanese traps with 89mm(3.5") diamond mesh in the trap bodies in Cape Broyle.

% reduction by number in small fish landings	% reduction by number in total catch	% reduction by weight in total catch
range(average)	range(average)	range(average)
15-17(16)	20-35(28)	14-26(20)

Table 5. Estimated percent reduction in small fish landings and total catch from using Newfoundland traps with 102mm(4") mesh in the back rather than Newfoundland traps with 89mm(3.5") mesh in the back in Bonavista.

% reduction by number in small fish landings	% reduction by number in total catch	% reduction by weight in total catch
range(average)	range(average)	range(average)
15-17(16)	15-17(16)	12-14(13)

Table 6. Estimated percent reduction in small fish landings and total catch from using a Newfoundland trap with 152mm(6"), 127mm(5") & 102mm(4") mesh in the sides with 102mm(4") mesh in the back rather than Japanese traps with 89mm(3.5") mesh in the trap bodies in Fogo.

% reduction by number in small fish landings	% reduction by number in total catch	% reduction by weight in total catch
range(average)	range(average)	range(average)
36-58(49)	54-66(59)	44-76(58)

Table 7. Average length of meshed fish by area.

LOCATION	MESH SIZE	AVERAGE LENGTH
LAWN	102mm(4")	44.7 cm (17.60")
LAWN	89mm(3.5")	39.6 cm (16.60")
ST. STEPHEN'S	127mm(5")	49.4 cm (19.45")
ST. STEPHEN'S	102mm(4")	45.8 cm (18.03")
ST. STEPHEN'S	92mm(3 5/8")	38.5 cm (15.16")
CAPE BROYLE	89mm(3.5") SQUARE	42.2 cm (16.61")
CAPE BROYLE	89mm(3.5") DIAMOND	40.7 cm (16.02")
BONAVISTA	152mm(6")	57.9 cm (22.80")
BONAVISTA	127mm(5")	53.9 cm (21.22")
BONAVISTA	102mm(4")	41.7 cm (16.42")
BONAVISTA	89mm(3.5")	38.5 cm (15.16")
FOGO	127mm(5")	56.4 cm (22.20")
FOGO	102mm(4")	42.3 cm (16.65")
FOGO	89mm(3.5")	38.1 cm (15.00")

Table 8. Average length of trapped fish retained by area.

LOCATION	TRAP	AVERAGE LENGTH
LAWN	D1	47.1 cm (18.54")
LAWN	D2	45.0 cm (17.72")
LAWN	D3	48.1 cm (18.94")
LAWN	D4	45.7 cm (17.99")
ST. STEPHEN'S	C1	52.0 cm (20.47")
ST. STEPHEN'S	C2	42.6 cm (16.77")
ST. STEPHEN'S	C3	42.4 cm (16.69")
CAPE BROYLE	B1	49.9 cm (19.65")
CAPE BROYLE	B2	46.7 cm (18.39")
CAPE BROYLE	B3	46.9 cm (18.46")
BONAVISTA	E1	53.1 cm (20.51")
BONAVISTA	E2	48.9 cm (19.25")
BONAVISTA	E3	50.1 cm (19.72")
FOGO	F1	50.2 cm (19.76")
FOGO	F2	42.5 cm (16.73")
FOGO	F3	45.5 cm (17.91")

Table 9. Average percentage by weight of catch meshed in sides and back in Lawn.

	TRAP			
CATCH SIZE(lbs)	D1 102mm(4")	D2 89mm(3.5")	D3 102mm(4")	D4 89mm(3.5")
500-999	17.6	19.4	13.2	14.0
1000-1999	10.0	10.0	14.3	11.0
2000-2999	8.0	8.0	10.6	10.3
3000-3999	---	5.0	6.5	6.0
4000-4999	---	4.0	---	5.0
5000-5999	---	---	---	---
6000-6999	---	3.0	---	---

Table 10. Average percentage by weight of catch meshed in the sides and back in Cape Broyle.

	TRAP		
CATCH SIZE(lbs)	B1 SQUARE 89mm(3.5")	B2 DIAMOND 89mm(3.5")	B3 DIAMOND 89mm(3.5")
500-999	26.0	16.0	10.0
1000-1999	9.0	11.8	11.9
2000-2999	----	7.9	----
3000-3999	5.4	----	11.2
4000-4999	7.7	----	10.0
5000-5999	8.7	----	5.1
6000-6999	5.9	----	7.9
7000-7999	5.6	8.9	----
8000-8999	5.3	----	----

Table 11. Average percentage by weight of catch meshed in the back in Bonavista.

	TRAP		
CATCH SIZE(lbs)	E1 102mm(4")	E2 89mm(3.5")	E3 102mm(4")
500-999	1.0	2.0	3.2
1000-1999	0.9	1.1	1.9
2000-2999	1.8	2.7	---
3000-3999	1.2	---	0.5
4000-4999	---	---	---
5000-5999	---	---	0.3

Table 12. Average percentage by weight of catch meshed in the back in Fogo.

	TRAP		
CATCH SIZE(lbs)	F1 102mm(4")	F2 89mm(3.5")	F3 89mm(3.5")
500-999	14.0	27.9	24.4
1000-1999	19.4	23.2	19.2
2000-2999	13.7	----	11.9
3000-3999	12.9	10.0	11.0
4000-4999	----	----	----
5000-5999	----	----	----
6000-6999	7.3	----	----

3. PORT KIRWAN. Sampling began June 27. Landings were very low (Table 1) with only 12,500 lbs. of fish taken from both traps monitored. Due to the lack of fish and damage to traps, the traps were taken up on July 30 after only hauling 10 times. As a result of the small sample size, an analysis of the data was not carried out.

The trap owner reported that there were no problems with hauling the square mesh trap.

4. CAPE BROYLE. Sampling began June 11. After a slow start, catch rates picked up with a total of 173,000 lbs landed from the three traps monitored (Table 1). Figures 6 & 7 show that the square mesh trap (B1) caught fewer small fish than the diamond mesh traps (B2 & B3). The average reduction in small fish landings was 27% (Table 4). The average lengths of trapped and meshed fish were greater in the square mesh trap than in the diamond mesh traps (Tables 7 & 8). The estimated loss from using square mesh was approximately 20% by weight and 28% by number (Table 4).

The trap owner felt that the square mesh trap worked well. He found that it was very easy to haul this trap by drying up to the side after releasing one of the funnel ropes.

The trap owner reported less meshing in the square mesh trap than in the diamond mesh traps. Table 10 confirms that, except for catch sizes less than 1000 lbs, the square mesh trap generally experienced less meshing than the diamond mesh traps.

5. BONAVISTA. Sampling began June 25. After a slow start, catch rates picked up with over 110,000 lbs. being landed from the three traps monitored (Table 1). Figures 8 & 9 show that the traps with 102mm mesh in the back (E1 & E2) caught less small fish than did the trap with 89mm mesh in the back (E2). The average reduction in small fish landings was 16% by number (Table 5). The average length of trapped and meshed fish in the 102mm mesh traps was greater than that of the 89mm mesh trap (Tables 7 & 8). The estimated catch loss from using 102mm mesh in the drying twine rather than 89mm mesh is approximately 13% by weight and 16% by number (Table 5).

There was no observed relationship between mesh size and the amount of meshing that results (Table 11).

6. FOGO. Sampling commenced on June 21. The trap fishery here was generally poor. Less than 100,000 lbs. of fish was landed from the three traps monitored (Table 1). Figures 10 & 11 show that the experimental trap (F1) caught significantly less small fish than the 89mm mesh traps (F2 & F3). The average reduction in small fish landings was 49% by number (Table 6). The average length of trapped and meshed fish caught from the experimental trap was greater than that of the 89mm mesh traps (Tables 7 & 8). The estimated catch loss from using the large mesh trap was approximately 58% by weight and 59% by number (Table 6).

There was no observed relationship between mesh size and the amount of meshing that results (Table 12).

7. LA SCIE. Sampling began July 18. Due to the very small catches (Table 1), no data analysis was carried out for this area.

8. CONCHE. Sampling began July 18. Due to the very small catches (Table 1), no data analysis was carried out for this area.

DISCUSSION OF RESULTS

Overall, catch rates for the particular traps monitored were low. As a result, in three areas, insufficient data was collected to warrant any meaningful statistical analysis. Furthermore, since the the experiments were carried out under commercial fishing conditions and with a short preparatory lead time, it was impossible to control all variables as should be the case in a perfect experimental setting. However, sufficient samples were obtained in five of the eight locations to examine the effect of large and square mesh on trap catches and the amount of meshing in cod traps.

REDUCTION IN SMALL FISH

Results show that traps that the use 102mm mesh rather than 89mm mesh in the drying twine caught significantly fewer small fish. The average reduction in small fish ranged from 16% (Bonavista) to 44% by number. Direct comparison of these results with the findings from other studies is difficult due to the different definitions of "small fish" used and the different length measurements taken (ie fork length vs. standard length) by

different researchers. The general trend, however, is one of significant reductions in small fish landings from using a 102mm minimum mesh size.

For experimental traps which had 127mm mesh in the sides in addition to the 102mm mesh in the back, the average reduction in small fish landings was somewhat larger - 49% (Fogo) to 59% (St. Stephen's) by number.

The use of square mesh also resulted in the retention of fewer small fish. However, since this is the only study that has addressed the selectivity of square mesh traps, this result should be interpreted cautiously.

For a trap of a given mesh size, the actual percent of catch made up of small fish should vary, depending on the size composition of the fish population exposed to the trap. In this study, the percent of small fish from traps with 102mm minimum mesh sizes ranged from 20 to 38%, whereas that of 89mm and 92mm mesh traps ranged from 27% to 66%.

ESTIMATED LOSS TO FISHERMEN

The results of this study indicate that increasing the minimum mesh size from 89mm to 102mm would result in a significant decrease in trap landings. Where traps had 102mm mesh in the drying twine compared to 89mm mesh, the estimated average reduction in catch ranged from 13% to 35% by weight. Table 13 shows that these estimates are within the range of estimates found by other researchers.

Table 13. Estimated immediate loss to trap fishermen from increasing the minimum mesh size in cod traps.

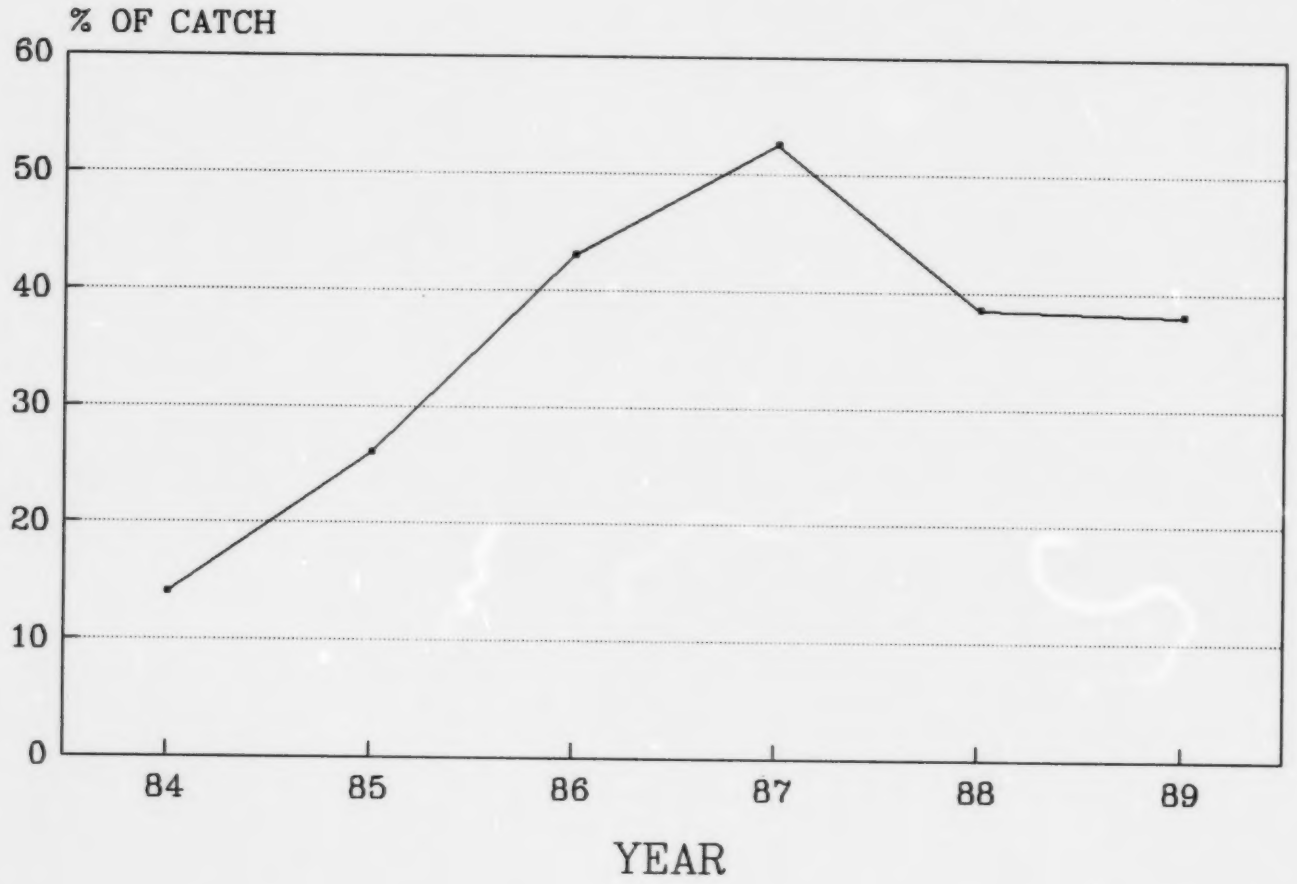
MESH SIZE	LOCATION OF STUDY	PERCENT LOSS	REFERENCE
3.5"-4"	St. John's	8%	Bishop, 1982
3.5"-4"	Renews	30%	Mercer & Allan, 1979
3.5-4"	Fogo Island	36%	Mercer & Allan, 1977
3.5"-4.5"	Renews	23%	Mercer & Allan, 1979
3.5"-4.5"	Fogo Island	27%	Mercer & Allan, 1979
3.5"-5"	St. John's	60%	Bishop, 1982
3.5"-5"	Fogo Island	72%	Mercer & Allan, 1979

In locations where the experimental traps had 102mm mesh in the back and larger, 127mm mesh in the sides, the estimated average reduction in catch ranged from 53% to 58% by weight. It is possible that these estimates are unusually high since there are indications that the population of fish that was exposed to the traps in these areas was smaller than normal. Figures 12 and 13 show the average percent by number of sampled trap catches under 43 cm(17") from 1984 to 1989. During this period, the average percent by number of small fish in division 3L ranged from approximately 15% to 52%, whereas the average percent of small fish in the St. Stephen's control traps was approximately 65%. For division 3K, the percent by number of small fish ranged from approximately 20% to 33% from 1984 to 1989, whereas the average percent of small fish from the Fogo control traps was approximately 50%. If we assume that the sampled traps from Figures 12 and 13 were using the minimum 89mm mesh in the drying twine, this would mean that the average size of fish in Fogo and St. Stephen's was unusually small this year. Bishop (1982), found that 89mm and 102mm traps differ in their selectivity over the range of 33 to 47cm fork length. Since the population of fish exposed to the traps contained a large percent of fish in this range, a large catch loss would result from using the experimental traps. This could account for the high estimates obtained in this study.

For a given fisherman, the actual level of catch reduction resulting from increasing the minimum mesh size of cod traps beyond 89mm would depend on the size distribution of the population of

Fig 12 Sampled Cod Trap Landings – 3L

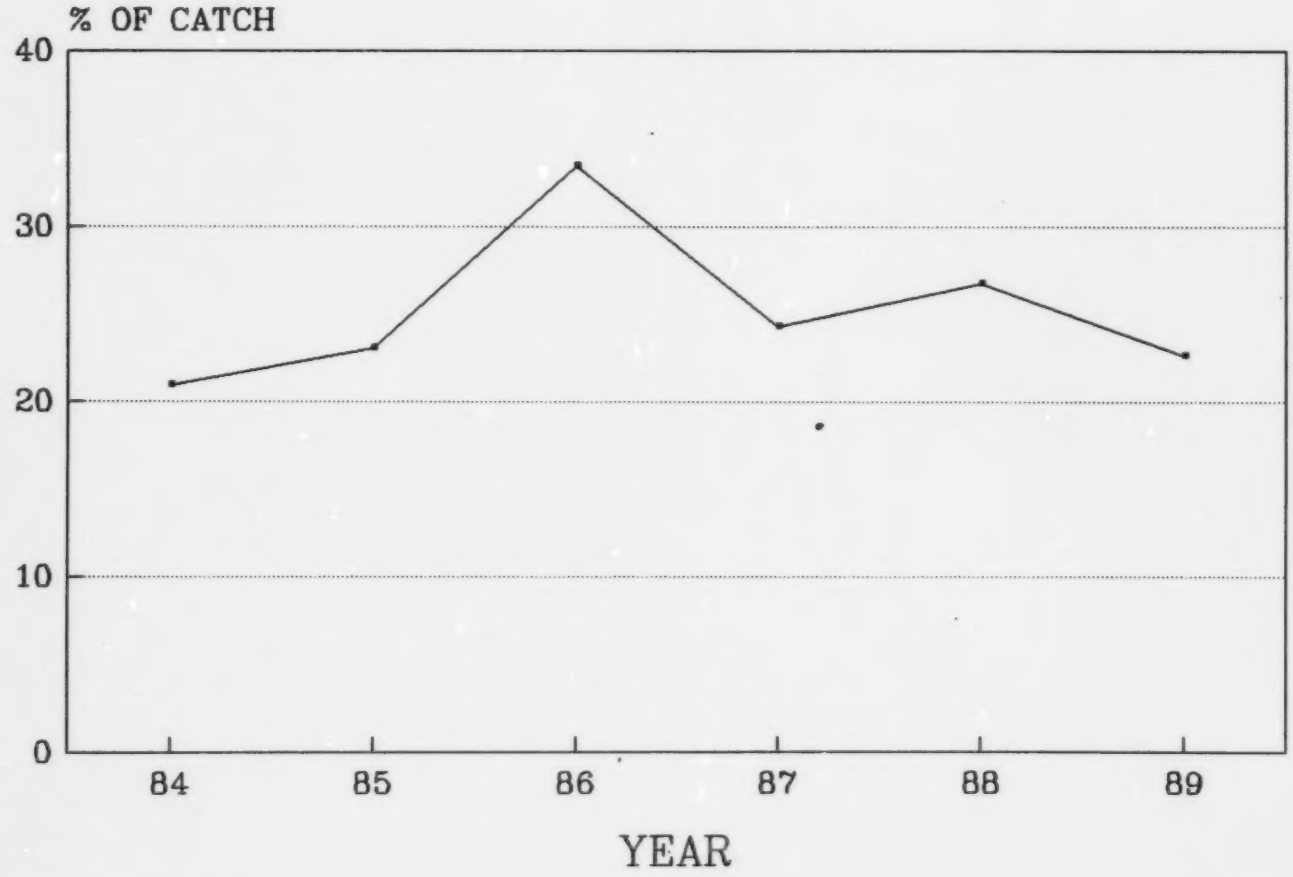
% Of Catch Under 43 cm (17")



Note: Data From DFO Commercial Port Sampling Program

Fig 13 Sampled Cod Trap Landings – 3K

% OF Catch Under 43 cm (17")



Note: Data From DFO Commercial Port Sampling Program

fish that move to the trap grounds. Certain locations are known to get a small run of fish and would experience large catch reductions if the minimum mesh size in cod traps was increased. Other areas are known to get a large run of fish and would not be significantly affected by an increase in the minimum mesh size.

It was estimated that the square mesh trap caught on average 20% less fish by weight than the diamond mesh traps in the same area. Again, since square mesh has only been tested on this one occasion, these results should be interpreted cautiously.

Bishop (1982) predicted that in the long run the loss from the trap fishery that would result from increasing the minimum mesh size of traps would not be fully recovered by the trap fishermen. It is predicted however, that other sectors of the fishery would experience an increase in landings. Since many trap fishermen also use gillnets, long line trawls and hand lines, their trap losses would be at least partially offset by increased catches from these other gear types. Furthermore, decreasing the amount of small fish sold to processors could lead to a higher average price for fish, further compensating the trap fishermen.

MESHED FISH

Large amounts of meshed fish have always caused problems for cod trap fishermen since much time is lost in clearing the traps. There have been suggestions by some fishermen and researchers that the amount of meshing may increase with mesh size. The results of this study, however, indicate that there is no clear relationship

between mesh size and the amount of meshing that results.

It was observed that the percent of total catch that was meshed decreased with increasing catch size. This was taken into account when comparing the amount of meshing in different traps by only comparing meshing for similar catch sizes. Mercer and Allan (1979) did not take this factor into account when they suggested that meshing in traps with 102mm or 127mm mesh in the drying twine was more severe than in traps with 89mm mesh in the drying twine. The 89mm mesh traps in that study however, had larger average catch sizes than the 102mm and 127mm mesh traps. This means that the 89mm mesh traps could have had a low percentage of meshed fish simply because of the large catch sizes. Other studies such as Bishop (1982) have supported the idea that large mesh traps do not cause a problem with meshing.

While most studies indicate that meshing is not a problem in traps using 102mm or 127mm mesh in the drying twine, most fishermen strongly disagree. Some fishermen have found, however, that meshing can be reduced by using particular materials such as vinlon or twine or by increasing the size of twine used in the traps. This study also found that square mesh may also reduce the amount of meshing in traps.

CONCLUSIONS

1. Increasing the minimum mesh size of cod traps from 89mm to 102mm or beyond results in a significant reduction in small fish landings. The use of square mesh may also contribute to the escapement of small fish.

2. Increasing the minimum mesh size of cod traps from 89mm to 102mm or beyond results in a significant decrease in total landings. The magnitude of loss will vary from area to area as the size distribution of the fish population moving to the trap grounds varies. The use of square mesh may also cause a reduction in total landings.

3. Increasing the minimum mesh size from 89mm to 102mm did not result in any increased problems with meshing. Most fishermen, however, strongly disagree. More work should be carried out in this area. The use of square mesh appeared to reduce the amount of meshing.

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